IMPERIAL MYCOLOGICAL INSTITUTE
21 AUG 1940

TANGANYIKA TERRITORY

DEPARTMENT OF AGRICULTURE

---

# Fifth Annual Report of the Coffee Research and Experiment Station, Lyamungu, Moshi 1938

1940
DAR ES SALAAM
PRINTED BY THE GOVERNMENT PRINTER
*Price Sh 1/50 (1s 6d)*

43069/5/40

TANGANYIKA TERRITORY

DEPARTMENT OF AGRICULTURE

# Fifth Annual Report of the Coffee Research and Experiment Station, Lyamungu, Moshi 1938

CONTENTS


PAGE

STAFF LIST AND LEAVE MOVEMENTS ... ... ... ... ... 5

SECTION

I. ADMINISTRATION—Chief Scientific Officer ... ... ... ... 5

II. REVIEW OF THE YEAR'S WORK—Chief Scientific Officer ... 6

III. IMPROVEMENT OF PLANT MATERIAL—Chief Scientific Officer ... 9

IV. VEGETATIVE PROPAGATION—Agricultural Assistant ... ... 10

V. IMPROVEMENT OF GROWING CONDITIONS—Chief Scientific Officer 15

VI. CHEMIST'S REPORT ... ... ... ... ... ... ... 24

VII. PLANT PATHOLOGIST'S REPORT ... ... ... ... ... 26

VIII. ENTOMOLOGIST'S REPORT ... ... ... ... ... ... 29

*Appendix:*

FINANCIAL STATEMENT OF EXPENDITURE OF COLONIAL DEVELOPMENT GRANT ... ... ... ... ... ... ... 39

Digitized by the Internet Archive
in 2025

https://archive.org/details/research-report-coffee_1938_5

# COFFEE RESEARCH AND EXPERIMENT STATION, LYAMUNGU, MOSHI

## Report for the Period 1st January to 31st December 1938

### Staff List

*Chief Scientific Officer* in general charge.—S. M. Gilbert, B.SC., N.D.A., DIP.AGRIC. (WYE).
*Plant Pathologist.*—G. B. Wallace, B.SC., PH.D.
*Entomologist.*—F. B. Notley, M.SC., A.I.C.T.A.
*Chemist.*—H. B. Stent, M.SC., A.I.C., A.I.C.T.A.
*Agricultural Officer.*—C. Harvey, B.SC. (AGRIC.), A.I.C.T.A.
*Agricultural Assistant* (Plant Propagator).—L. M. Fernie.
*European Clerk.*—C. H. Taylor.

### Leave Movements during the Year

| | Departed | Returned |
|---|---|---|
| Mr F. B. Notley ... ... | — ... | 6th March 1938 |
| Mr F. R. Sanders ... ... | 1st May 1938 ... | — |
| Mr C. Harvey ... ... ... | — ... | 15th October 1938 |

### Section I.—Administration

In the five years since its birth in 1934 the station has steadily developed and has almost passed out of the adolescent stage into the full life of an adult. During the course of this development it has been possible to see clearly certain signposts which indicate the ways in which the aims of the station may be achieved. It remains only for steady progress to be continued along these paths of investigation for useful economic results to be gained for the coffee industry.

The specialist staff has had an uninterrupted year of work. On the agricultural side, however, leave and transfers have had the effect of slowing down investigations. Nevertheless, an increase in the number of recorders has enabled the programme of cooperative experiments to be broadened.

Funds for the station were met mainly by a free grant of £4,000 from the Colonial Development Fund; this sum was augmented by a contribution of £1,264 from departmental sources. As heretofore, the cost of the Plant Pathologist, Entomologist and Agricultural Officer was met from the votes of the Agricultural Department. (See Appendix I.)

#### VISITORS

His Excellency the Governor visited the station in August during his tour of the Northern province.

Colleagues from neighbouring territories and Amani were welcomed. Other visitors were A. V. Gilbey of Mark Lane, London, and Drs M. Hilb Ris Lambers and van der Veen from Java.

Delegates of the Usa and West Meru Planters' Association as well as individual planters visited the station.

The Tanganyika Coffee Growers' Association and the Coffee Board of Tanganyika held meetings at the station and at the March meeting of the latter E. Harrison, C.M.G., Director of Agriculture, presided as chairman of the Board for the last time prior to retirement.

### PUBLICATIONS

Quarterly Notes have been published regularly during the year in English and German. The circulation is now seven hundred and although the publication is mainly for local planters there is a considerable demand from overseas.

Members of the staff have contributed the following articles to the *East African Agricultural Journal*:—

"Selection within *Coffea Arabica* in Tanganyika Territory" by S. M. Gilbert.
"Variability in Yield of *Coffea Arabica*" by S. M. Gilbert.
"A Non-Parasitic Disease of Coffee" by G. B. Wallace.
"Plant Diseases Spread by Bugs" by G. B. Wallace.

### BUILDINGS

The coffee factory and drying shed were completed in time for the first crop and by concentrating picking it was possible to use the power machinery for non-experimental coffee.

### SUB-STATION—MBOSI

Under the supervision of the Agricultural Officer, Mbeya, four six-by-six latin squares have been prepared for testing the seedling progeny of twenty-four potential selections; the experiment will be planted during the 1938-39 rains.

## Section II.—Review of the Year's Work

### *Station Development*

Table I

| Development | Acres |
|---|---|
| Coffee ... ... ... ... ... ... | 51 |
| Nurseries ... ... ... ... ... ... | 7 |
| Banana and fodder grasses ... ... ... | 14 |
| Paddocks ... ... ... ... ... ... | 9 |
| Wind belts and coppices ... ... ... ... | 26 |
| In course of preparation for experiments ... | 91 |
| Forest ... ... ... ... ... ... | 30 |
| Roads, buildings, gardens, etc. ... ... ... | 26 |
| Undeveloped (not including forest) ... ... | 56 |
| Total Area ... | 310 |

Steady progress has been made both in the preparation for and the planting of coffee experiments.

Three six-by-six latin squares have been planted to test the seedling progeny of eighteen selections and land is ready for further similar experiments. An extension of the estate demonstration of three acres awaits the advent of the rains when it will be planted.

Three five-by-five latin squares for tests of artificial manures, one five-by-five latin square for a mulch experiment and one five-by-five latin square for a replication of experiment III have been prepared and await sufficient clones for planting.

Areas under bananas, elephant grass and guinea grass have been extended.

TABLE II

*Meteorological Summary for the year ending* 31*st December* 1938

| | Temperatures | | Humidity | | Sunshine | Rainfall |
|---|---|---|---|---|---|---|
| | Mean Maximum | Mean Minimum | 9 a.m. | 3 p.m. | | |
| | °Centigrade | °Centigrade | % | % | Hours | m.m. |
| January ... | 29·3 | 14·0 | 72 | 42 | 221 | 13·3 |
| February ... | 29·3 | 14·8 | 80 | 61 | 228 | 61·8 |
| March ... | 27·4 | 15·6 | 79 | 58 | 152 | 315·7 |
| April ... | 24·3 | 15·5 | 90 | 70 | 112 | 274·1 |
| May ... | 21·5 | 15·2 | 94 | 74 | 61 | 493·8 |
| June ... | 20·6 | 14·0 | 87 | 62 | not | 66·4 |
| July ... | 21·4 | 13·1 | 86 | 55 | recorded | 48·8 |
| August ... | 21·2 | 12·3 | 80 | 51 | 120 | 16·9 |
| September | 23·6 | 12·7 | 81 | 45 | 128 | 4·6 |
| October ... | 25·9 | 13·5 | 80 | 44 | 156 | 55·1 |
| November... | 26·0 | 14·0 | 81 | 52 | 157 | 64·5 |
| December | 25·7 | 14·8 | 79 | 58 | 178 | 25·8 |

Climatic conditions, except for rainfall, were very similar to those of 1937. The total rainfall for the year was 1,440·8 millimetres (fifty-seven inches). During the last half of the year it was insufficient to carry over coffee planted in the long rains and it was necessary to resort to watering. The erratic annual rainfall and the irregularity of its distribution in this district contribute greatly to the difficulties of field experimentation.

### IMPROVEMENT OF PLANT MATERIAL

Five years' records have been completed on some hundred trees; only a few have proved to be regular bearers. Five trees have fully satisfied the tests to which they were subjected. Field trials have been laid out in several areas with seedling material to study the behaviour of their progeny.

### IMPROVEMENT OF GROWING CONDITIONS

Recording of both uniformity trials and field experiments has been carried out on about fifty estates and native holdings. Investigations into the technique of field experiments are now complete.

On the station useful practical knowledge has been obtained in regard to establishing young coffee. Studies of methods of providing the organic matter necessary to the maintenance of soil fertility have progressed.

On estates the indications are that in very wet years additional nitrogen is necessary at the end of the long rains. Mulches are clearly beneficial in dry years while farmyard manure and compost are improving yields on some soils.

### VEGETATIVE PROPAGATION

Towards the end of the year progress was made in solving various practical problems connected with vegetative propagation. Briefly, soft wood cuttings rooted most quickly. Certain plant hormones accelerated rooting. Grafting on a small scale was successful.

### SOIL INVESTIGATIONS

The Chemist continued his studies on the effect of vegetable mulches on nitrate production and on conservation of soil moisture. It is noteworthy that the depression of nitrification caused by grass mulch can be overcome by the application of a small dressing of sulphate of ammonia.

The effect of cultural treatments on the humus content of the soil was investigated and the composition of cattle manures and composts used in large scale field experiments was studied.

The failure of young coffee in a limited area on the north-western side of Mount Meru was shown to be associated with the accumulation of alkali carbonate in the deeper horizons of the subsoil.

Work concerning the "die-back" peculiar to the Sanya area was continued, but so far this problem has not been solved.

### PLANT PATHOLOGY

The Plant Pathologist devoted much of his time to studying rust disease (*Hemileia vastatrix*) to obtain a satisfactory yet simple and quick means of comparing spray treatments. Records of growth, leaf-fall and disease incidence are being taken in detail and present indications are that results of value will be obtained during the coming year. Of the fungicides applied, Bordeaux mixtures of 1·0 and 0·5 per cent strengths maintain their well-known value for Hemileia control.

In the Babati and Oldeani coffee districts, which were visited, disease is not serious. Where Hemileia occurs it could be largely controlled by spraying. Yellowing is common in the coffee, but should be reduced by providing shelter from the cold winds, and possibly by applying a copper spray as a tonic.

### ENTOMOLOGY

The Entomologist paid special attention to problems connected with the coffee leaf-miners and in this work he is collaborating with the Entomologist at Amani. Two areas on which outbreaks occurred were studied in detail, and in the case of one of these miners, *L. coffeella* Guer, a suggestion as to the fundamental cause of outbreaks is put forward. *Antestia* also occupied his attention: field observations on the amount of damage caused, as compared with the more usual estimate made during the cleaning of coffee, suggest that *Antestia* must be reduced to a much lower concentration in the field than was hitherto considered necessary to avoid serious losses. Studies of field control of *Antestia* and the effect of insecticides on the parasite *Corioxenos* were initiated and further work on the relation of climate to outbreaks of thrips was continued.

Lyamungu,
March 1939.

S. M. Gilbert
*Chief Scientific Officer*

## Section III.—Improvement of Plant Material

Records have been completed for the fifth year on many potential selections.

In consequence of the consistent opinions of the trade that compactness of bean is connected with quality a beginning has been made with the study of specific gravity of beans. After this work had been started attention was called by Anstead* to similar work in India some thirty years ago. There is a wide variation between random samples of beans from different trees, the specific gravity ranging from 1·40 down to 1·15 in those studied. Fortunately, beans from our best trees are all of high specific gravity so that whether correlation with quality is subsequently proved or not they do meet that test. Tentative studies indicate, however, that this quality is connected rather with the roasting qualities than with the actual "cup" qualities. For example, tree H66, with a very heavy and large bean, produced beans of a specific gravity of only 1·15 over two years; it received a good report for "cup" qualities but a poor one for "roast." Table III shows the extremes in this character with their weight and volume, for the ten most compact and the ten least compact samples examined. Correlation studies on a much wider scale are contemplated; liquorer's reports rather than prices are to be used as being less subject to fluctuations.

### Table III

*Random ungraded samples of four hundred beans per tree*

| Tree No. | Weight per bean, grammes | Volume per bean, c.c.'s | Specific gravity |
|---|---|---|---|
| | *10 Best Trees* | | |
| Q180 ... ... | ·165 | ·118 | 1·40 |
| N197 ... ... | ·167 | ·121 | 1·38 |
| N71 ... ... | ·150 | ·114 | 1·32 |
| E59 ... ... | ·166 | ·128 | 1·30 |
| Q267 ... ... | ·189 | ·145 | 1·30 |
| R3 ... ... | ·156 | ·121 | 1·30 |
| L1 ... ... | ·170 | ·133 | 1·28 |
| H1 ... ... | ·194 | ·152 | 1·27 |
| N39 ... ... | ·173 | ·137 | 1·27 |
| N81 ... ... | ·176 | ·139 | 1·27 |
| | *10 Worst Trees* | | |
| H66 ... ... | ·192 | ·167 | 1·15 |
| D122 ... ... | ·179 | ·156 | 1·15 |
| Q311 ... ... | ·178 | ·152 | 1·17 |
| F689 ... ... | ·184 | ·157 | 1·17 |
| B160 ... ... | ·150 | ·128 | 1·17 |
| R1 ... ... | ·164 | ·139 | 1·18 |
| N29 ... ... | ·180 | ·151 | 1·19 |
| E665* ... ... | ·153 | ·129 | 1·19 |
| N18 ... ... | ·175 | ·146 | 1·20 |
| N17 ... ... | ·171 | ·143 | 1·20 |

*100 bean sample — Results multiplied by four.

*Anstead: A Note on Quality of Coffee; *Agric. and Livestock in India*, VIII, Part II March 1938, pp. 148-151.

Selection has continued on similar lines to those employed last year and trees are grouped according to definite characteristics. In the first class are a few trees which meet all criteria of selection; the characteristics of five of them are given in table IV below. It is worthy of note that the liquorer distinguishes between individual trees in the same plot in regard to their type of liquor.

TABLE IV

| Tree No. | Average mean yield over 5 years in cwt. of clean coffee per acre | Regularity of bearing | Bean Characters | | | Liquorer's report confirmed for two years |
|---|---|---|---|---|---|---|
| | | | Weight in grammes | Volume in c.c. | Specific gravity | |
| L1 ... | 19·32 | Regular | ·170 | ·133* | 1·28* | Fine to good |
| N39 ... | 22·24 | ,, | ·183 | ·141 | 1·30 | Good |
| N197 ... | 21·21 | ,, | ·193 | ·150 | 1·29 | ,, |
| R3 ... | 20·96 | ,, | ·164 | ·126 | 1·30 | Fair |
| N71 ... | 18·75 | ,, | ·180 | ·138 | 1·30 | ,, |

*1937 figures.

Other trees meet all tests except the quality of regular annual bearing; others are shy yielders but carry desirable beans. Until more is known trees of all groups will be recorded.

The crucial test was begun this year. How will the seedling progeny of these trees behave in the different districts ? Experiments using latin squares are being used to this end. Vegetative propagation by rooting cuttings continues but the best trees seem more difficult to root than others; in any event they usually carry less material suitable for cuttings.*

Lyamungu,
March 1939.

S. M. GILBERT
*Chief Scientific Officer*

---

## SECTION IV.—VEGETATIVE PROPAGATION

During the year under review greatest attention has been paid to methods of rooting cuttings. Some grafting has been done in the nursery and in the frames and a small amount of budding was attempted, but lack of suitable budwood restricted this work.

### CUTTINGS

On this station rooted cuttings are chiefly required for the multiplication of selected trees, to provide uniform plants for field experiments and for use as clonal rootstocks.

*Methods of procuring cuttings.*—As was found previously,† the best method of treating mother trees is to grow them on the multiple stem system, remove all primary branches and peg down the main stems horizontal with the ground. Suckers will then grow up vertically from the "eyes," and provide suitable material for use as cuttings.

---

*The carbohydrate-nitrogen relationship in the trees is probably connected with this.—Director of Agriculture.

†Third Annual Report of Coffee Research Station, 1936.

This procedure is impossible with certain trees such as selections from which the primaries cannot be removed. Under these circumstances, the only material available is the few suckers that arise from the main stem. Generally speaking this is unsuitable material as the suckers have elongated internodes and are usually weak. It is possible but difficult to root cuttings from this type of material, especially if the cuttings have to be conveyed a long distance to the propagating frames. A much quicker method of establishing such trees is to graft scions from the selected tree or trees on to seedling rootstocks and to plant them in a propagating frame. The humid atmosphere accelerates callus formation and subsequent union of the graft. A hardwood scion, consisting of two nodes, is very suitable and if all the "eyes" are allowed to develop, the young clone is on multiple stem from the outset. The use of softwood scions is still under investigation.

Once a good union is formed, the clone can be planted out in the nursery, grown up on multiple stem, removing all primaries, and each stem eventually pegged down horizontally to provide material suitable for cuttings. Care must be taken to mark the point of union carefully, so that no cuttings are inadvertently taken from the rootstock.

Artificial shade only should be provided for these young clones and when properly established it is best to remove all shade. If excessive scorching of the leaves occurs, a light shade, natural or artificial, should be provided, but it should be as light as possible.

Subsequent work will be greatly facilitated if a number of clones from the same trees are planted out in the nursery in this manner; for only thus can a large number of cuttings be obtained from the same tree or trees.

*Types of cuttings.*—Both hard- and soft-wood cuttings have successfully rooted, but the latter type shows more promise, and also is more readily available. Hard-wood cuttings generally take longer to root and, once rooted, are more difficult in after treatment. Some success has been obtained by treating hard-wood cuttings with growth-promoting substances; semi-hard cuttings, that is, those hard at the base, but retaining the green tip and a certain amount of foliage, have also been successfully rooted after treatment.

*Soft-wood cuttings.*—These have been generally the most successful and the most readily obtainable. The best type of cutting is that with three or four nodes and short internodes. These cuttings require the use of a propagating frame in which a high humidity can be maintained.

After the cuttings have been taken the lower leaves are removed and the remainder are trimmed, care being taken to remove and burn any diseased leaf or part of a leaf. It is preferable to remove any small primary branches. A clean cut with a sharp knife is made at the base just below a node and the cutting is then ready for setting in the frame.

*Hard-wood cuttings.*—Ordinarily, this type of cutting takes much longer to root than the soft-wood cutting. Shoot-growth on this type of cutting must not be taken as a sign of root-formation, as it is often only induced by the high humidity. Hard-wood cuttings are prepared in the same way as soft-wood cuttings except that they are usually leafless.

*Propagating frames.*—Various types of frames are in use at the station, but the original ones described in a previous report are the most satisfactory, although it has been found necessary to modify the amount of shade which is given.

*Drainage.*—This is provided by means of stones at the bottom of the frames to a depth of one and a half to two feet. Large stones should be placed at the bottom, smaller ones in between and on top, and finally a layer of pebbles or gravel; on this is placed the rooting medium.

*Rooting media.*—Various potential rooting media are on trial. Though this experiment is by no means complete, there is every indication that a mixture of peat moss and coarse river sand at two to one is the best rooting medium. Other organic media on trial are sifted, well-rotted leaf mould and sifted, broken coconut fibre. Each of these was mixed with coarse sand and fine sand in a proportion of two to one. All the mixtures with the coarse sand seem preferable to those with the fine sand, with the exception of the mixture of leaf mould and fine sand, which ranks second to the peat moss and coarse sand mixture.

The medium is prepared and mixed in the potting-shed and then transferred to the frames, where it is spread out evenly to a depth of from four to six inches. As a precaution against *Rhizoctonia* disease, which was so prevalent last year, a fresh medium is always watered in thoroughly with Cheshunt compound. If cuttings are not set immediately, the medium should receive another watering immediately prior to setting; further direct watering of the medium should be unnecessary.

*Temperature.*—It has been found that no bottom heat is required on this station and during the hot dry weather it is necessary to keep the temperature down to between 20°C and 25°C by frequently watering the outside of the glass and frames.

*Humidity.*—An almost saturated atmosphere in the frames is necessary. The relative humidity is kept up to about ninety by means of a fine mist spray over the cuttings once or twice a day according to the external climatic conditions. As a general rule this should also provide sufficient moisture for the rooting medium after the initial watering given to the latter. Clean water only, from spring or tap, should be used.

*Light.*—This is very important. The maximum amount of light must be afforded, but direct sunlight must not be allowed to fall on the frames. Previously the glass was covered with a coat of paint, and a layer of cheesecloth placed on top; over all was an overhead shade of hessian, nine feet above the ground. Under these conditions there was excessive leaf-fall and death of cuttings, though a small percentage did root.

Now, only the overhead shade remains and it is hoped that the rate of mortality will be greatly reduced under these conditions.

*Rooting of cuttings.*—The time taken for cuttings to produce roots is very variable, being anything from five weeks to well over a year; a fair percentage will root in three to six months. During the year nine hundred cuttings were rooted; the average time taken to root was nineteen and a half weeks.

*After treatment of rooted cuttings.*—When the cuttings have struck, that is, when roots one to two inches long have been produced, they are potted up in banana baskets containing a rich compost to which a little sand has been added. They are immediately returned to the frames for three or four weeks, or longer if the amount of leafage is very small, to recover from the check of transplanting. Thence they are removed to the cool atmosphere of the forest, where they harden-off for a further two to three months. After that period,

the baskets should be full of roots, and the young clones are ready to plant out in the nursery under shade to await planting in the field, or intensive propagation in the nursery.

*Growth promoting substances.*—A number of synthetic substances, known to promote root-formation on cuttings of other plants were tested on *Coffea arabica* cuttings.

A large experiment, which included seven of these substances, was laid down in the frames but, unfortunately, the frames were too heavily shaded and the substances probably used at too high a concentration. This experiment will be repeated later, when some better indication of the optimum strengths of the various substances has been ascertained.

No definite results are yet available, but two substances gave indications of being successful:—

(1) "Hortomone A".—This solution was used with advantage on leafy cuttings that were hard or semi-hard at the base; a certain amount of success was also obtained by treating hard leafless cuttings though root-formation was slower on this type. The treatment accelerated rooting and caused the development of more roots per cutting.

It seems probable that the strength of solution must be regulated according to the type and size of cutting, that is hard-wood leafless cuttings of large diameter require a stronger concentration than cuttings of smaller diameter only semi-hard at base. Too high a mortality occurs among the true soft-wood cuttings treated. Although the light factor referred to above may be partly responsible for this, it is also possible that weaker concentrations will give better results. An experiment using this solution at weaker concentrations was laid down in the last month of the year.

(2) *Beta-indolyl-acetic acid.*—This was tried at varying strengths but no definite results are available although there are indications that when used at a strength of 1 : 20,000, it does accelerate the rooting of cuttings of *C. arabica* and induce the growth of more roots per cutting.

## GRAFTING

Grafting has only been done in the nursery and shows every promise of success during the dry weather. The type of graft employed was the "cleft" graft which is probably the simplest and strongest.

Grafting was done on to seedling stocks only, and a successful "take" was shown at any time after two months. No grafting wax or tape was necessary. An overhead shade of grass or banana leaves was provided. The completed graft was enclosed in a cylindrical banana-stalk cover; this serves its purpose but is apt to attract termites. The scions were hard-wood consisting of two or three nodes. It was necessary to keep the soil moist by means of frequent waterings. So far there has been no success during the rainy season.

Insulating tape was tried, merely to seal the point of union, and was used in conjunction with raffia and not instead of it. This appears beneficial, hastening callus formation and "take" of graft, but further trials are necessary.

*Grafting in frames.*—Seedlings were grafted and then planted in a propagating frame and so far this method gives every promise of success. A seedling, the stem of which is of approximately the same diameter as that of the scion it is required to graft, is dug up and the grafting operation carried out on the

bench in the potting-shed. The roots are trimmed and the grafted seedling is then planted in a frame. The humid atmosphere induces rapid callus formation, and a fair percentage "take" is shown after four to six weeks. When shoot growth has commenced, the plant is potted up like a cutting, returned to the frame for a short time and eventually placed outside to harden off. Hard-wood scions are preferable, as soft wood appears to be less easy to harden off on removal from the frames. Further investigation is necessary on the use of soft-wood scions.

It will be possible to carry out grafting in any month of the year if this method is successful.

*Grafting on to cuttings in frames.*—Both cleft and whip-and-tongue grafts have been successfully used on cuttings in frames. A hard-wood cutting is taken as stock, but it is normally slow rooting; this disadvantage might be overcome by using growth substances. Green soft-wood terminal shoots and suckers have been successfully grafted on to hard-wood cuttings. With all grafting in the frames, it is advantageous to use some sort of protection of wax or tape at the point of union.

### INARCHING

This is useful for testing various seedling root-stocks. As with cleft grafting, this also has only been done in the dry weather, when watering is necessary. The graft can be expected to "take" after about two months; it is advisable to leave it longer before the scion is completely severed from its own roots.

### BUDDING

Less work has been done on budding, principally owing to lack of suitable budwood, which will never be so readily available as material for grafting. Budding appears to be very much slower than grafting and the buds may lie dormant for many months before breaking.

### SUMMARY

Small soft-wood cuttings with short internodes are the most suitable and can be expected to root after three to six months.

Peat moss mixed with coarse river sand is the best rooting medium so far tried and, with other mixtures, coarse sand is generally preferable to fine sand.

An overhead shade of hessian provides sufficient light but protects the frames from direct sunlight.

Of the growth substances on trial, "Hortomone A" is beneficial for leafy cuttings hard or semi-hard at the base and, to a lesser extent, for hard leafless cuttings. Response to treatment shows more roots per cutting, and acceleration of rooting. Beta-indolyl-acetic acid at a concentration of 1 : 20,000 gives indications of accelerating rooting. The cleft graft and inarching are successful in the nursery under shade during the dry weather but constant watering is necessary.

Lyamungu,
March 1939.

L. M. Fernie
*Agricultural Assistant*

## Section V.—Improvement of Growing Conditions

*General.*—Individual tree recording has continued on all uniformity trials. The statistics concerning those on which treatments have not yet been applied are summarized in table V.

Table V

| Estate | Year | Number of trees | Mean yield in kilos of cherry per tree | Standard deviation | Coefficient of variation percentage |
|---|---|---|---|---|---|
| A | 1934 | 593 | 0·36 | 0·54 | 148·6 |
| | 1935 | 593 | 1·42 | 1·27 | 89·6 |
| | 1936 | 644 | 0·88 | 0·89 | 101·2 |
| | 1937 | crop failed | — | — | — |
| | 1938 | 644 | 1·79 | 1·74 | 97·5 |
| G | 1934 | 246 | 2·92 | 2·68 | 91·7 |
| | 1935 | 246 | 4·08 | 2·79 | 68·4 |
| | 1936 | 246 | 1·22 | 1·43 | 117·0 |
| | 1937 | 246 | 1·30 | 1·31 | 100·5 |
| | 1938 | 246 | 0·50 | 0·62 | 124·9 |
| I | 1934 | 517 | 5·28 | 3·81 | 72·2 |
| | 1935 | 517 | 0·99 | 1·25 | 125·7 |
| | 1936 | 517 | 4·00 | 2·48 | 62·0 |
| | 1937 | 517 | 0·54 | 0·91 | 169·5 |
| | 1938 | 517 | 3·96 | 3·02 | 76·4 |
| J | 1934 | 797 | 4·11 | 3·51 | 85·4 |
| | 1935 | 797 | 1·60 | 1·86 | 116·2 |
| | 1936 | 390 | 3·32 | 2·10 | 90·6 |
| | 1937 | 390 | 4·30 | 3·01 | 69·9 |
| | 1938 | 390 | 0·82 | 1·29 | 156·7 |
| N | 1934 | 241 | 11·81 | 6·05 | 51·2 |
| | 1935 | 241 | 1·81 | 2·32 | 128·2 |
| | 1936 | 241 | 5·63 | 4·52 | 80·2 |
| | 1937 | 241 | 3·42 | 3·46 | 101·2 |
| | 1938 | 241 | 6·24 | 5·47 | 87·7 |
| Q | 1935 | 319 | 2·71 | 2·22 | 81·8 |
| | 1936 | 319 | 1·51 | 1·82 | 120·0 |
| | 1937 | 319 | 3·67 | 2·45 | 66·7 |
| | 1938 | 319 | 2·46 | 2·04 | 83·2 |
| R | 1935 | 100 | 5·55 | 5·62 | 101·2 |
| | 1936 | 100 | 5·73 | 5·11 | 89·2 |
| | 1937 | 100 | 3·95 | 5·56 | 141·0 |
| | 1938 | 100 | 1·33 | 1·31 | 98·8 |
| T | 1935 | 684 | 2·13 | 1·16 | 54·8 |
| | 1936 | 684 | 0·41 | 0·44 | 107·9 |
| | 1937 | 684 | 0·46 | 0·47 | 102·2 |
| | 1938 | — | — | — | — |
| U | 1937 | 900 | 6·98 | 3·29 | 47·1 |
| | 1938 | 900 | 0·71 | 1·03 | 144·1 |

| Estate | Year | Number of trees | Mean yield in kilos of cherry per tree | Standard deviation | Coefficient of variation percentage |
|---|---|---|---|---|---|
| W | 1937 | 900 | 2·52 | 1·85 | 73·6 |
| | 1938 | 900 | 2·28 | 1·58 | 69·1 |
| X | 1937 | 355 | 4·21 | 3·27 | 77·6 |
| | 1938 | 355 | 2·55 | 2·17 | 84·9 |
| Y | 1937 | 792 | 2·86 | 2·02 | 70·7 |
| | 1938 | 792 | 1·26 | 0·89 | 70·7 |
| Z | 1937 | 900 | 1·63 | 1·22 | 74·6 |
| | 1938 | 900 | 3·26 | 1·90 | 58·1 |
| AA | 1937 | 1,024 | 1·76 | 0·99 | 56·2 |
| | 1938 | 1,024 | 1·66 | 0·93 | 55·8 |
| AB | 1937 | 250 | 4·88 | 2·44 | 50·0 |
| | 1938 | 250 | 0·82 | 0·82 | 100·0 |
| AC | 1937 | 209 | 5·24 | 4·15 | 79·2 |
| | 1938 | 209 | 2·93 | 4·46 | 152·2 |
| AF | 1937 | 900 | 5·04 | 2·73 | 54·2 |
| | 1938 | 900 | 4·75 | 2·06 | 43·4 |
| AG | 1937 | 900 | 3·46 | 2·69 | 77·6 |
| | 1938 | 900 | crop failed | — | — |

As a matter of general interest yields, as far as available, are presented for all blocks on which recording has been done.

## Table VI

*Yield of Clean Coffee per Acre of all Recorded Blocks, in hundredweights*

(Five years 1934-38)

| Estate | 1934 | 1935 | 1936 | 1937 | 1938 | Average for five years |
|---|---|---|---|---|---|---|
| A | 2·0 | 7·9 | 6·9 | * | 8·8 | 5·1 |
| B | 1·2 | 7·6 | 7·7 | 6·9 | 5·8 | 5·8 |
| C | 5·7 | 2·8 | 2·2 | ‡ | * | 3·6 |
| D | 3·1 | 5·1 | 2·9 | 6·4 | * | 3·5 |
| E | 0·9 | 11·2 | 7·8 | 5·4 | 5·1 | 6·1 |
| F | 4·8 | 5·7 | 4·2 | 3·1 | 2·5 | 4·1 |
| G | 6·0 | 8·3 | 2·6 | 2·4 | 0·8 | 4·0 |
| H | 19·0 | 3·7 | 7·1 | 4·4 | ‡ | 8·5 |
| I | 10·9 | 1·5 | 7·4 | 0·5 | 7·6 | 5·6 |
| J | 4·2 | 1·5 | 2·9 | 5·0 | 1·0 | 2·9 |
| K | 7·5 | * | 4·8 | 1·0 | * | 2·7 |
| L | 9·9 | 8·3 | 3·7 | 6·1 | * | 5·6 |
| M | 8·9 | 0·6 | 5·4 | * | 5·5 | 4·1 |
| N | 22·8 | 3·3 | 11·9 | 6·5 | 8·1 | 10·5 |
| O | 0·2 | 4·2 | 0·8 | 3·0 | * | 1·6 |
| P | 5·5 | 8·4 | 3·2 | 4·2 | 1·8 | 4·6 |
| Q | † | 7·3 | 4·5 | 9·0 | 4·6 | 6·4 |
| R | † | 12·7 | 13·5 | 7·6 | 2·7 | 9·1 |
| S | † | 3·8 | * | ‡ | ‡ | 1·9 |
| T | † | 2·4 | 0·5 | * | ‡ | 0·7 |
| U | † | † | † | 12·2 | 0·0 | 6·1 |
| W | † | † | † | 4·7 | 4·7 | 4·7 |
| X | † | † | † | 9·5 | 5·6 | 7·5 |
| Y | † | † | † | 5·0 | 2·3 | 3·1 |
| Z | † | † | † | 2·1 | 4·1 | 3·2 |
| AA | † | † | † | 4·1 | 3·9 | 4·0 |
| AB | † | † | † | 9·1 | 1·3 | 5·2 |
| AC | † | † | † | 9·8 | 5·7 | 7·7 |
| AF | † | † | † | 6·2 | 6·4 | 6·3 |
| AG | † | † | † | † | 1·4 | 1·4 |
| AH | † | † | † | † | 1·6 | 1·6 |
| AJ | † | † | † | † | 5·5 | 5·5 |
| AK | † | † | † | † | 3·5 | 3·5 |
| AN | † | † | † | † | 8·2 | 8·2 |
| AO | † | † | † | † | 5·6 | 5·6 |
| AP | † | † | † | † | 1·1 | 1·1 |
| AQ | † | † | † | † | 2·0 | 2·0 |
| AR | † | † | † | † | | |
| Mean Cwt | 7·0 | 5·3 | 5·0 | 5·0 | 3·3 | |
| Acreage | 17·3 | 20·1 | 20·1 | 29·9 | 66·8 | |

Average over all estates over all years = 4·64 hundredweights per acre.

* = Crop failed. † = Not recorded. ‡ = Abandoned.

For comparison with other years yields of eight thousand non-experimental trees are given in kilograms of cherry per tree.

| | | | |
|---|---|---|---|
| Mean of all | ... | ... | ... Kg. 2·37 |
| Standard deviation | ... | ... | 2·31 |
| Coefficient of variation | ... | ... | 97·77 per cent |

Nearly five thousand of the trees gave less than two kilograms of cherry per tree.

EXPERIMENTS ON ESTATES

*1936 Series.*—The crop failed on estates L and O.

Table VII shows the total plot yields of the various treatments on two estates for three years.

TABLE VII

*Yield of Cherry in kilograms* (twenty trees per plot)

| Estate | Year | Treatments | | | | Rainfall |
|---|---|---|---|---|---|---|
| | | Nil | Sulphate of ammonia | Farmyard manure | Mulch (grass unnamed) | |
| F | 1936 | 192 | 220 | 240 | 266 | Low |
| | 1937 | 180 | 321 | 244 | 182 | High |
| | 1938 | 87 | 94 | 99 | 120 | Low |
| | | Nil | Sulphate of ammonia | Compost | Mulch (Guinea grass) | |
| | 1936 | 313 | 297 | 301 | 360 (Elephant grass) | Low |
| B | 1937 | 367 | 352 | 466 | 352 | High |
| | 1938 | 244 | 287 | 258 | 280 | Low |

*Estate F.*—Mulch has had a beneficial effect in the two dry years whilst sulphate of ammonia substantially increased yields in the wet year.

*Estate B.*—On this estate mulching was stopped in 1938 as the grass interfered with the cultivation by oxen; half quantities of compost and sulphate of ammonia were substituted. No definite conclusions can be drawn.

*1937 Series: Estate E.*—This experiment was laid out as a result of laboratory indications that the soil had poor water-holding capacity. As irrigation is normally practised on this estate it was important to discover ways of conserving the moisture, table VIII sets out the results for two years.

TABLE VIII

*Yield of Cherry per plot in kilograms*

| Estate | Year | Treatments | | | | Rainfall |
|---|---|---|---|---|---|---|
| | | Nil | Guinea grass | Farmyard manure | Mulch (grass) | |
| E | 1937 | 230 | 241 | 214 | 329 | Low |
| | 1938 | 295 | 253 | 328 | 249 | High |

Treatments are nearly significant for P = ·05.

Interactions between treatments and season are clearly significant with grass mulch (unnamed) again proving beneficial in a year of low rainfall and farmyard manure in one of high rainfall.

*1938 Series.*—While no differences due to treatments have been obtained in the first year of application, it has been shown that the "lay-out" is very suitable, differences on any one experiment of the order of twenty-five per cent being demonstrable.

### Table IX

### Large Scale Manurial Experiments

*Kilograms of cherry—mean plot yields*

| Estate | Trees per plot | Number of replications | Treatments | | | | General mean per plot | Standard error |
|---|---|---|---|---|---|---|---|---|
| | | | Nil | Sulphate of ammonia | Framyard manure | Half and half | | |
| AJ | 100 | 10 | 90·6 | 92·2 | 85·6 | 89·0 | 89·35 | 8·8 |
| AK | 100 | 10 | 299·6 | 320·6 | 329·1 | 323·2 | 318·12 | 4·8 |
| AN | 100 | 10 | 214·7 | 224·4 | 199·9 | 204·2 | 210·73 | 4·6 |
| AP | 100 | 8 | 331·4 | 324·6 | 301·4 | 323·0 | 320·09 | 6·3 |
| AR | 100 | 10 | 111·5 | 116·9 | 118·7 | 96·8 | 110·97 | 5·6 |

It is, of course, fundamental that similar experiments should be carried out in several localities and over several seasons. To obtain knowledge as to the increase in precision gained by the grouping of the above experiments the results for this first year have been combined and the variance due to locality removed. The effect of locality is tremendous and the combined analysis has had the encouraging result of reducing the plot error to 3·03 per cent which will enable the set of experiments to demonstrate differences due to treatments of less than ten per cent.

### Station—General

*Stock.*—To provide adequate organic manures for the coffee the cattle herd is gradually being increased and now comprises twenty-nine animals including calves. The management of the herd has been changed with successful results. Cotton-seed, elephant grass and guinea grass are fed.

*Compost.*—Increased areas of fodder grasses such as elephant and guinea grasses and sufficient cattle have made it possible to manufacture some sixty tons of compost; this has been enough for nursery requirements and for a liberal dressing to all coffee.

*Experiment I—Method of planting.*—This experiment, planted in 1935 with seedling material of Kent's type, gave its first crop in 1938. The results which are outstanding are given below. The yields are heavy but the trees show no sign of strain and have set another good crop. They were assisted by the application of two ounces per tree of "Niciphos" and some compost after the long rains.

TABLE X

*Yield of Clean Coffee per Acre in hundredweights*

| | No Holing | *H3F1 | †H F1 | Hole Subsoiled | | | | Mean |
|---|---|---|---|---|---|---|---|---|
| | | | | Without Compost | | With Compost | | |
| | | | | H3 F1 | H F1 | H3 F1 | H F1 | |
| Deep Ball ... ... | 10·9 | *12·9* | 7·0 | 11·6 | 8·0 | 11·1 | 11·1 | 10·4 |
| Deep Bare ... ... | 10·6 | 10·7 | 9·6 | *12·7* | 10·2 | *12·5* | 9·5 | 10·8 |
| Nursery Ball ... ... | 11·2 | *15·3* | 11·7 | *13·7* | 12·0 | *17·1* | 10·7 | 13·1 |
| Nursery Bare ... ... | 11·8 | *13·7* | 9·3 | *13·7* | 10·6 | *14·7* | 10·6 | 12·1 |
| Mean ... ... ... | 11·1 | *13·1* | 9·4 | *12·9* | 10·2 | *13·9* | 10·5 | 11·6 |

Figures in italics are significantly greater than the mean for P = ·01.

*H3 F1 = holed three months before planting and holes filled one month before.

†H F1 = holed and filled one month before planting

Under the conditions at this station the best method of planting is shown to be holing three months before planting, sub-soiling one foot deep, filling in one month before planting and mixing compost with the surface soil at the rate of half a petrol tin per hole at the time of filling. The plants had balls of earth and were planted at nursery level.

Other indications are that planting at nursery level is better than deep planting and that compost has, to date, had little effect. The number of trees under each sub-treatment was one hundred and forty.

*Experiment II—Cover Crops.*—Owing to the ill effects resulting from growing cover crops in coffee in other areas without adequate moisture, this experiment has been taken out of the programme. Certain cover crops will, however, be included in experiment XV—Irrigation—which, it is expected, will be planted with clonal material in 1940.

The land reserved for experiment II, some twelve acres, has therefore been allotted to experiments on seedling progeny of selected trees.

*Selection Garden.*—During the year three latin squares of six-by-six plots have been planted up with seedling progeny of sixteen selections. A further latin square and two sets of randomized blocks have been prepared for the long rains. This provides for trials of a further twenty-four selections. The plants are ready in the nursery awaiting suitable rains.

*Experiment III—Comparison of clones and seedling material from the same trees.*—The planting of this experiment is not quite complete because of lack of clonal material in the long rains of 1938; this material is now ready but it is considered wiser to wait until the 1939 rains before putting the plants out in the field. In view of the importance of this experiment it is being repeated on another site which has already been prepared.

*Experiment IV—Seedling stocks for grafting.*—This experiment comprises nine different five-by-five latin squares. Top working will not be done until more is known about the technique of budding and grafting in the field.

The exotic coffees are difficult to establish without shade.

*Experiment V—Artificial manures.*—This experiment has been recast to include experiment VI. It will comprise three five-by-five latin squares. The land has been prepared and awaits the clonal material for planting.

*Experiment VII—Age at planting.*—The conclusions drawn from this experiment are that coffee up to two years and a half of age can easily be established in the long rains and maintain its relative advantage in size in comparison with younger coffee. Cutting back the seedlings of all ages caused a serious check. This result is confirmed in other areas on the station.

The experiment, having fulfilled its purpose, is now used as a demonstration of methods of conversion to multiple coffee.

*Experiment VIIA—Conversion of single stem coffee to multiple stem* (*vide* Quarterly Notes No. 6, page 21, June 1938).

The oldest coffee treated was five years, that is, two years and a half old stumps at planting which had been in the field three years.

The operations were carried out in November and suckering is freely taking place with all methods.

*Experiment VIII—Soil erosion demonstration.*—Owing to the absence of torrential downpours in 1938 the quantities of soil eroded from the various plots are less marked than in previous years. The Kent's coffee, age four years, gave its first crop; the data are summarized below.

TABLE XI

*Yield per Acre in hundredweights*

| | Clean cultivation | Contour hedge | *Weeds across slope | Contour hedge and cover crops | Banana mulch | Procumbent cover crop | Erect cover crop |
|---|---|---|---|---|---|---|---|
| Cherry ... ... | 32·25 | 40·41 | 59·69 | 41·17 | 68·09 | 43·31 | 40·24 |
| Parchment ... | 5·10 | 6·25 | 9·96 | 6·72 | 10·94 | 5·85 | 5·90 |
| †Clean ... ... | 4·00 | 4·81 | 7·76 | 5·33 | 8·45 | 4·63 | 4·69 |
| Peaberry ... | 0·74 | 0·67 | 1·11 | 0·78 | 1·07 | 0·70 | 0·69 |
| ‡Eroded Soil tons per acre ... | 2·90 | 1·84 | 1·57 | 1·44 | 1·02 | 0·94 | 3·72 |

* = Average of two plots. † = Includes peaberry

‡Previously the average loss for three years had been twenty-one tons from the controls and only one ton from the treated areas.

It is thus once more demonstrated that banana trash mulch is an effective anti-erosion measure and increases the yield.

*Experiment IX—Methods of cultivation.*—The first crop shows no differences due to various methods of cultivation but an error in trenching, which was done close up to the trees, has reduced crop considerably. The cause was apparently straightforward damage to the roots at a critical time (June). Table XII gives the results.

TABLE XII

*Yield per Acre in hundredweights*

| | Fork hoe | Hoe | No cultivation | Envelope forking | Trenching | Mean |
|---|---|---|---|---|---|---|
| Cherry ... | 35·93 | 36·05 | 34·94 | 28·34 | 12·24 | 29·50 |
| Parchment ... | 6·89 | 6·78 | 6·88 | 5·41 | 2·33 | 5·66 |
| Clean ... | 5·64 | 5·55 | 5·56 | 4·36 | 1·82 | 4·59 |

Trenching has given yields lower than all others (P=·01).

*Experiment X—Artificial shade.*—This experiment was planted with clonal material in the long rains of 1938; the plants are making good progress.

Overhead shade, consisting of canvas strips with different sizes of gaps, is in position. This has been placed about sixteen feet above ground level; later sidescreens will be added.

*Experiment XI—Variety trial.*—This has had to be abandoned as an experiment owing to widespread physiological trouble resulting in "die-back" in the Blue Mountain selection. As, however, direct comparison between Kent's and Bourbon types under known conditions appear to be rare the trial will be continued. Results for the first crop are given below in table XIII.

TABLE XIII

*Yield per Acre in hundredweights*

| | Kent's | Bourbon |
|---|---|---|
| Cherry ... ... | 64·1 ... | 59·3 |
| Parchment ... ... | 12·3 ... | 10·8 |
| Clean ... ... ... | 9·9 ... | 8·7 |

There is no significant difference between the yields from two types, but the Bourbon crop appears to be earlier maturing than the Kent's.

*Experiment XII—Selection in nursery.*—The value of careful selection of the best seedlings in the nursery is amply demonstrated in this experiment. Table XIV below sets out the yields from the first crop. Periodical measurements of growth from the first year of planting are correlated with yields. (*Vide* Quarterly Notes No. 8, page 5, December 1938.)

TABLE XIV

*Yield per Acre in hundredweights*

| | R. Good T. Cut back | R. Good T. Good | R. Average T. Average | R. Poor T. Good | R. Good T. Poor | R. Poor T. Poor | Mean |
|---|---|---|---|---|---|---|---|
| Cherry ... ... | 17·65 | 35·90 | 25·32 | 28·77 | 22·76 | 17·91 | 24·72 |
| Parchment ... | 3·16 | 5·78 | 4·51 | 5·38 | 3·89 | 3·28 | 4·33 |
| Clean ... ... | 2·56 | 4·52 | 3·67 | 4·29 | 3·10 | 2·63 | 3·46 |
| Peaberry ... | ·34 | ·65 | ·46 | ·57 | ·40 | ·33 | ·46 |

R=Roots. T=Tops.

*Experiments XIII*, A, B *and* C—*Multiple versus single stem.*—These experiments bore a small "fly" crop and no results are yet available.

*Experiment XIV—Mulching.*—Table XV below gives the yield from the first crop yield in this experiment.

## Table XV

*Yield per Acre in hundredweights*

| Treatments | Cherry | Parchment | Clean |
|---|---|---|---|
| Banana Mulch ... ... ... | *42.28* | *6·76* | *5·29* |
| Grass Mulch ... ... ... ... | *26·07* | *4·56* | *3·65* |
| Crotalaria in long rains ... ... | 14·01 | 2·73 | 2·17 |
| Crotolaria in short rains ... ... | 10·92 | 1·94 | 1·57 |
| Clean weeded once per month ... | 15·68 | 2·70 | 2·09 |
| Weeds as Mulch ... ... ... | 17·53 | 3·44 | 2·68 |
| Crotalaria in long and short rains ... | 12·24 | 2·45 | 2·00 |
| Clean weeded once per month and compost ... ... ... ... | 17·09 | 3·26 | 2·63 |
| Mean ... | 19·48 | 3·48 | 2·76 |

Yields in italics are significantly higher than all others.

The yields are confirmed by growth measurements. Mulching is clearly beneficial. Owing to the deleterious effects of growing cover crops in the coffee these treatments have now been amended to include elephant grass with and without sulphate of ammonia.

The experiment is being repeated as experiment XIVA, with clonal material; the plants are almost ready.

*Experiment XV—Irrigation.*—Progress has been made in preparing land for this experiment. It is expected that preliminary investigation and the constructional work will be completed in 1939; planting with clonal coffee plants should be possible in 1940.

*Experiment XVI—Spacing.*—Until more is known about types most suitable to these conditions it is felt that no useful purpose can be served by planting this experiment. Spacing must obviously vary for different types, for different methods of pruning and for different environments. For example, four-year old Kent's coffee trees at this station overlap at nine feet spacing.

*Experiment XVII—Age-Limit.*—Two plots of Bourbon and Kent's coffee have been planted out for 1937 and 1938. Material is ready in the nursery for the 1939 planting.

*Native Demonstration Area.*—No differences in treatments are yet discernible. A small crop has set and will be picked in 1939.

*Estate Demonstration.—1937 Planting.* This coffee is making good growth and has set a small crop. Contour ridging as an anti-erosion measure has proved very effective and distinct terraces have already formed.

*1939 Planting.* Based on experience gained to date a further three acres have been opened up for planting. Seedling selections will be used. As the site is a fairly steep slope every fifth row, on the contour, has been planted with elephant grass. This will serve both as an anti-erosion measure and provide mulch. The permanent shade will be *Albizzia marangu-ensis*, and *Sesbania aegyptica* will provide temporary shade.

E. M. Gilbert
*Chief Scientific Officer*

Lyamungu, March 1939.

*Nitrification Studies and Mulching.*—In the last report were recorded data illustrating the effect of mulching with banana trash and with grass on nitrate production in the soil at Lyamungu. It was shown that nitrification was considerably enhanced under the banana trash and appreciably depressed under the grass mulch. During the warm dry weather in January and February 1938, nitrate contents increased under all treatments, the plots treated with grass mulch still containing appreciably less than the others until just before the break of the rains at the end of March.

After the main rains were over, all plots received two ounces of sulphate of ammonia per tree; this had the effect of immediately raising the nitrate content. During the following two months, weed growth depressed the nitrate content of untreated plots, whereas mulch plots increased in nitrate nitrogen, slowly during the cold weather, then more rapidly, under each mulch; the sulphate of ammonia overcame the previously observed depressing influence of grass mulch on nitrate content.

These remarks refer to soil growing unshaded young coffee. On a neighbouring estate observations were made on soil growing native coffee, well shaded. Here again, the nitrate status was higher under banana trash, but the conservation of soil moisture was less marked, presumably because an appreciable amount of untreated ground was sufficiently shaded to depress weed growth and so automatically restrict loss of moisture.

At Marangu and Boloti, grasses used for mulching did not depress nitrate production at the critical time of the year when nitrate content was at a minimum; at Kikafu, however, grass was found to do so.

The effect of mulching on crop yield in these experiments is recorded elsewhere. One may repeat here, however, the indication that wherever and whenever rainfall is excessive during the months of April and May, severe leaching of nitrate occurs and causes nitrogen starvation; this can be corrected by application of nitrogenous fertilizers. Where rainfall during the main rains falls below the average the response to nitrogen is poor, but the mulching becomes effective; in this case the limiting factor is moisture and not nitrate.

*Manurial Experiments and Manures.*—A number of large scale field experiments were commenced in 1938 to compare the effect of applying nitrogenous fertilizers and organic manures at the end of the long rains. Samples of the cattle manures and composts used were analysed and compared.

The materials available for application differed considerably in maturity and composition from place to place. The dry matter content varied from eighteen to fifty-one per cent in the case of cattle manures and from fifty to ninety per cent in the case of composts. The rate of application is measured by volume and not by weight so that the amount of dry matter applied was fairly constant.

The percentage of inert earthy material varied from 7·5 to 46·4 in the case of cattle manure and from 42 to 62 in the case of compost.

The following are the details of analyses:—

TABLE XVI

| | Cattle Manures | | Composts | |
|---|---|---|---|---|
| | Mean | Range | Mean | Range |
| | Per cent | Per cent | Per cent | Per cent |
| Dry Matter ... ... ... ... | 37 | 18–51 | 64·5 | 50–90 |
| Composition of Dry Matter: | | | | |
| Organic Matter ... ... ... | 39 | 21–67 | 17 | 12–27 |
| Nitrogen ... ... ... ... | 1·33 | 0·80–2·21 | 0·73 | 0·50–1·17 |
| C/N Ratio ... ... ... ... | 17 | 11–23 | 13·5 | 13–13·5 |
| $P_2O_5$ Total ... ... ... | 1·25 | 0·56–1·93 | 0·83 | 0·69–1·00 |
| $P_2O_5$ Available ... ... ... | 0·49 | 0·05–0·80 | 0·25 | 0·03–0·40 |
| $K_2O$ Total ... ... ... ... | 2·22 | 1·28–3·66 | 1·57 | 1·12–1·95 |
| Exchangeable ... ... ... | 1·70 | 0·84–3·21 | 1·38 | 1·01–1·81 |
| Acid soluble Ash ... ... ... | 16·3 | 11–21 | 17·8 | 9·6–30·1 |
| Insoluble Silicate ... ... ... | 28·4 | 7·5–46·4 | 51·6 | 42–62 |

An experiment designed to test the effect of boosting compost with combinations of fertilizers was commenced. The fertilizers N, P, K, NP, NK, PK and NPK were added to the compost raw materials in order to see whether the disintegration could be accelerated by this procedure. The rate of decomposition was not affected by their inclusion, probably because the materials used had been grown on soil rich in mineral nutrients.

The addition of nitrogen to the mixture appears to have been wasteful as the final product contained hardly any more nitrogen than untreated compost.

Potassium sulphate gave an increase of between five and fifteen per cent of potash in the final product but did not increase the amount of exchangeable potassium, while rock phosphate doubled the percentage of total $P_2O_5$ and increased the readily available $P_2O_5$ by fifty per cent.

### FIELD PROBLEMS

*Sanya Die-Back.*—A "sudden death" of coffee in this area is still under investigation. Analyses of leaf material from affected and healthy trees suggested the possibility of manganese deficiency but the injection of manganese salt into chlorotic leaves or stems failed to correct the chlorosis.

The analytical data furnish evidence of some nutritional disorder, but the cause is not yet clear. Leaf ash from affected trees contains slightly more alkali and appreciably less calcium and magnesium than that from healthy trees—on a neutral soil which contains large quantities of exchangeable calcium and magnesium. On the other hand, the percentage of these bases in leaf ash from such unhealthy trees is comparable to that found in leaf ash taken from some of the highest yielding and healthiest trees in Tanganyika. There is no appreciable difference in iron or chlorine contents as between healthy and unhealthy leaves.

*Engare Ol Motoni Leaf-Fall.*—Abnormal and serious leaf-fall is common in certain parts of this area. Leaf material has been collected for analysis, but no definite conclusion can be reached from the data. It appears that at

the time of the leaf-fall the magnesium content of the leaves is below the average. When the trees have recovered, three months later, the magnesium content increase to normal. Here, again, there is no lack of exchangeable magnesium in the soil.

*Ol Donyo Sambu Die-Back.*—In this area the rapid die-back and subsequent death of coffee can be attributed to adverse subsoil conditions, associated with the accumulation of alkali. This type of die-back is restricted to seepage zones where alkali produced by weathering of the volcanic ash accumulates in the deeper soil horizons.

TOURS

A visit to the Mbeya and Mbosi areas was made.

Soil samples were collected on the site of the sub-station at Mbosi. Other samples were collected for pot culture work on the phosphate status of the soils of Mbosi: these confirmed the chemical diagnosis of a phosphate shortage, more particularly on the lighter textured soils.

A week was spent visiting native-grown coffee in the Rombo and Useri areas. A contrast was drawn between intensively manured soils in the banana groves where young coffee promised well and land further from the homestead which received no manure.

Several visits were made in the Arusha, Sanya and Kilimanjaro areas for survey and special investigations.

Lyamungu,
March 1939.

H. B. Stent
*Chemist*

---

## Section VII.—Report of Plant Pathologist

*Hemileia.*—Leaf disease (*Hemileia vastatrix*) has been the chief disease studied. Two spray experiments were undertaken; the first commenced in 1937 and the other in 1938. Another, commenced in 1937, has had to be abandoned as the trees have become unsuitable.

The first experiment was referred to in the 1937 annual report; it is a comparison between Bordeaux mixtures of one and point five per cent strengths and a proprietary preparation of copper hydroxide diluted to 1 : 400. These fungicides were applied in March. From August onwards various field data were obtained monthly: leaf-fall, shoot growth, new leaf formation, numbers of infected leaves and leaf-spots. The crop was also recorded. There are not yet sufficient observations to be of much value, but there are indications of the relative importance of the factors.

In the first place the crop is found to vary so much from tree to tree and even from plot to plot under any one treatment, and also from year to year that crop records will require to be taken for several years. There are, however, indications that information concerning vegetative characters can show results during the year following treatment. At present the most hopeful is monthly records of leaf-fall based on counts of fallen leaves from about fifteen trees under each treatment. This is also the most easily obtained of the observations being made.

The second spray experiment is a comparison of cuprous oxide (·233 per cent) with Bordeaux mixture of one per cent strength. A trial with four per

cent Bordeaux applied with fog sprayers had to be postponed till 1939, but the plots reserved for it constitute a useful second series of controls in 1938 Similar field data were observed in this as in the first experiment.

In the first experiment the figures for leaf-fall from August to December were: in the control plots 14,175; after one per cent Bordeaux 6,143, that is less than half; after point five per cent Bordeaux 6,909; after copper hydroxide 12,616, that is not much less than in the controls. Not only is the total leaf-fall during the period heavier in the control and copper hydroxide plots, but it occurred earlier than in either of the Bordeaux series.

In the second experiment leaf-fall counts were as follows: control 6,465; second control 7,125; one per cent Bordeaux 1,659; cuprous oxide 3,827—that is intermediate in intensity. Leaf-fall was not earlier in the controls in this experiment.

The occurrence of light leaf-fall simply means delayed leaf-fall and trees on which this happens are able to retain a good leafage and thus a greater surface for carbon assimilation than trees with heavy or early leaf-fall. This must result in a greater amount of food in the former for increased growth and for meeting the needs of the growing crop.

All the leaves must fall eventually, and over a sufficiently long period, say a year or more, the total fall will be much the same in all series of plots. More useful therefore than intensity of leaf-fall will be figures for the average length of life of leaves in each series of plots, and this will be obtainable when counts of leaves on marked twigs have been recorded for a longer period. It may be possible to correlate length of life of leaves with intensity of leaf-fall during certain months.

The ultimate criterion of the value of any fungicidal treatment must be its effect on cropping but, as stated, this information cannot be obtained even approximately until several years' records have been taken. If, however, it is found possible to correlate with crop a vegetative factor so simply and early obtainable as leaf-fall the knowledge would be of very great value.

The data so far obtained has other indications. Leaves formed even after spray treatment appear to be longer lived and less diseased than leaves formed at the same time on unsprayed trees. This may be largely the result of a tonic effect of the copper in the fungicides; a tonic effect has been observed on Kenya plantations where Hemileia is absent. The Hemileia infection on the experiment plots is so low that its control cannot entirely explain the differences in leaf-fall.

The counts of infected leaves and of leaf-spots are each considerably higher in the control trees than in treated trees. Counts over a number of months are necessary since at certain times, for example, the end of December, all the plots have very similar numbers of both infected leaves and leaf-spots. For small differences in results of treatments it is doubted if much reliance can be placed upon such counts since the heavier the infection the more likely are leaves to fall and thus not to be included.

As regards the value of cuprous oxide and copper hydroxide as fungicides for Hemileia, the present indications are that the former is of more value than the latter, but that neither is so effective as Bordeaux mixture. These fungicides cannot, however, be dismissed on the present data; observations over a longer period will be made. In the annual report of the Coffee Scientific

Officer at the Mysore Coffee Experiment Station, 1937-38, two copper oxide sprays were tested against Hemileia and both were said to have shown promising results.

Data on growth, leaf-formation, etc., are being obtained in detail and should have useful applications later.

*A Non-parasitic Disease of Coffee.*—A disease referred to in the 1936 annual report, page 85, as "A cankering of coffee stems" has been further studied. No parasite has been found; on the other hand sufficient evidence has been obtained that the trouble is a result of careless planting and cultural methods. An illustrated account of the disease has been submitted for publication in the *East African Agricultural Journal* early in 1939.

*Coffee Die-Back.*—In February, coffee trees on land with a western aspect were seen to have a varying number of dead twigs and leaves. The season was very hot and dry. Out of three hundred and eighty-nine trees fifty-six were diseased, the number of diseased twigs per affected trees varying from one to fifty, the average being seven In no case did a tree succumb completely

The symptoms differ from those in normal die-back, where death starts at the tip and spreads steadily downwards. In the present trouble the twigs are affected, but at the nodes. One or both sides of individual nodes turn brown or black and dark brown lines appear in the wood below. The leaves at these parts turn brown, hang down and soon fall. The discoloration at a leaf base spreads downwards more quickly than upwards or laterally. The inside of the twig becomes dried and mealy and may become hollow. When the disease spreads across the entire width of the twig the distal parts naturally die and wither. Dead twigs may be soft and leathery or brittle and easily snapped across.

Several fungi were isolated from diseased twigs, but none brought about disease in artificial inoculations. This was attempted, however, just as the trouble was ceasing to spread in the field, that is, with the advent of the rains in March. It is believed that the trouble is directly associated with the intense sunshine in the early months of the year and that it is alleviated by the cloudy weather during the rains. If this is correct it is thought that the provision of light shade would prevent the trouble arising. Some features of this disease resemble those of "Elgon die-back" in Kenya, but it is not certain that the two troubles are identical. The effect of shading some of the trees is to be tested.

*Coffee at Babati and Oldeani.*—No reference has previously been made to coffee diseases in these areas. The Entomologist and I visited them in early July. A few of the commoner diseases were observed: Hemileia occurs on some plantations; *Cercospora coffeicola* and a yellowing of the leaves are both rather common and appear to be associated with the cold winds at the higher elevations up to six thousand three hundred feet. Spraying for Hemileia is being undertaken. The Cercospora and yellowing are being controlled to some extent by the provision of windbreaks, such as avenues of trees on the roads, strips of maize between fields and lines of Tephrosia and other plants in the fields. Trials with four per cent Bordeaux applied with fog sprayers were to be made. The amount of coffee bean disease was rather high but this could be controlled by reducing the Antestia population.

*Beans*

Efforts to grow satisfactory crops of beans by coffee planters in the Northern province have met with discouraging results in recent years. A number of varieties, chiefly of french or kidney beans, were grown in 1938 at the Coffee Research Station and kept under observation. While the weather conditions were all in favour of healthy crops it was possible on the basis of symptoms in the plants to confirm the presence of Halo blight, a bacterial disease referred to in a memorandum at the end of 1937. Mosaic, a virus disease, was suspected. Rust was common but mild. *A Rhizoctonia* sp. was identified at the Imperial Mycological Institute from samples of Madagascar butter beans, but there was doubt about its identity with any of the recorded races of the *R. Solani* group. Anthracnose and yeast spot were present.

Halo blight is undoubtedly one of the chief causes of poor yields, but there may be others. Beans are, however, so useful a crop from many points of view that their culture should be continued and recommendations for disease control followed.

A dry year such as 1938 appears to have more effect in controlling blight and rust than any other factor. Where possible resistant varieties should be grown. Varieties susceptible to blight should only be grown from seed taken from a healthy crop and sown on land which has not been under beans for at least five years. Seed for the following year should be sown singly and wide apart on a plot of land away from the main crop, and both the growing plants and the harvested crop should be rogued.

The market for french beans is uncertain, but one variety which will be further investigated is Lightning. That variety belongs to the group including Canadian Wonder and Canadian Express (susceptible varieties) and Peerless, a resistant variety. Lightning is susceptible, but in the trials was little affected; it bore the largest crop of the twenty-four varieties tested, namely, at the rate of fifteen hundredweights and a half per acre. Further details regarding bean diseases will be given in a separate report which will be distributed to those interested.

GEO. B. WALLACE
*Plant Pathologist*

---

## SECTION VIII.—ENTOMOLOGIST'S REPORT

### LEAF-MINER

Research on the two leaf-miners of coffee, *Leucoptera coffeella* Guer. and the species provisionally identified as *L. daricella* Meyr. has formed the major part of the year's work. Arrangements were made for collaboration with the Entomologist, Amani, on this subject.

The main line of investigation undertaken at the Coffee Research Station was a continuation of the previous year's work under more accurate conditions. Two areas were chosen on the station where coffee is growing under completely different eco-climates. In the first the coffee (Amani selections) is under heavy shade and sheltered; in the second (experiment IX) the coffee is unshaded and on a western slope. A row of five trees was chosen in each of these areas. All mined leaves were stripped from the trees at the beginning of the experiment, and at fortnightly intervals thereafter (except that the first

collection of leaves took place three weeks after the beginning of the experiment). The mined leaves removed were examined; the total number of eggs of each species recorded and the two species placed separately into emergence boxes. The moths and all species of parasites were recorded as they emerged from day to day.

At the same time collections of pupae were made in the field, placed separately in tubes and emergences recorded.

It will be more convenient to deal with each area separately; experiment IX is almost entirely a *coffeella* area, and Amani selections a *daricella* area.

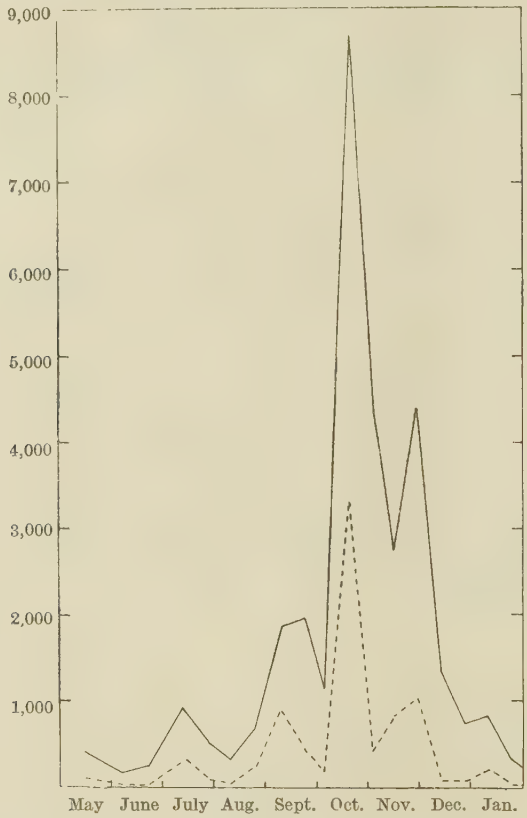


**Fig. 1.**—*L. coffeella* **Experiment IX.**

*Unbroken line:* **Number of eggs from five trees.**
*Broken line:* **Total adult emergences from above collections.**

*Experiment IX—L. coffeella.*—When the experiment commenced, in April, there was very little leaf-miner. *L. daricella* was absent, while *L. coffeella* eggs averaged thirty-six per tree only. The number increased rapidly until in October a full count was impossible and the egg numbers were estimated from counts from two hundred mined leaves. This proved to be the peak of the outbreak and thereafter the number of eggs decreased rapidly. At the peak, however, very serious damage was being done. Various other areas under similar conditions on the station appeared to be going through the same cycle at about the same time.

**Fig. 2.—Percentage of eggs hatching** *L. coffeella.*

The egg counts are given in figure 1. It will be noticed that the rise and subsequent fall in the total number of eggs is not regular, but increases are followed regularly by decreases. On this figure is also given the total number of adult moths which emerged from these eggs. The percentage is rather small, since firstly the conditions were highly artificial and, secondly, parasites took their toll. The percentage of emergences is, however, interesting. It varies from about ten per cent to nearly fifty per cent in a periodic manner (figure 2). The reason for this periodicity is discussed below.

Figure 3 shows the daily emergences of adults over the whole period. At once a definite periodicity is obvious. The adult emergences show a normal distribution round five peaks of varying size. These peaks are more or less equidistant at about forty-five days intervals; they appear to represent separate generations of the moths. From the first to the second peak is rather a longer interval than the others, but this is explained by the lower temperatures at this time of year.

The reason for the periodic curve for egg laying then becomes clear. The outbreak is of the "dominant stage" type: that is, at any given time the

majority of the insects will be at the same stage of development.* The extreme form of this condition would be where all the insects were of exactly the same age; but this condition cannot persist for long owing to the length of time over which eggs are laid, and the variation in length of life history of individuals. It will be seen in figure 3 that the main emergence in the first

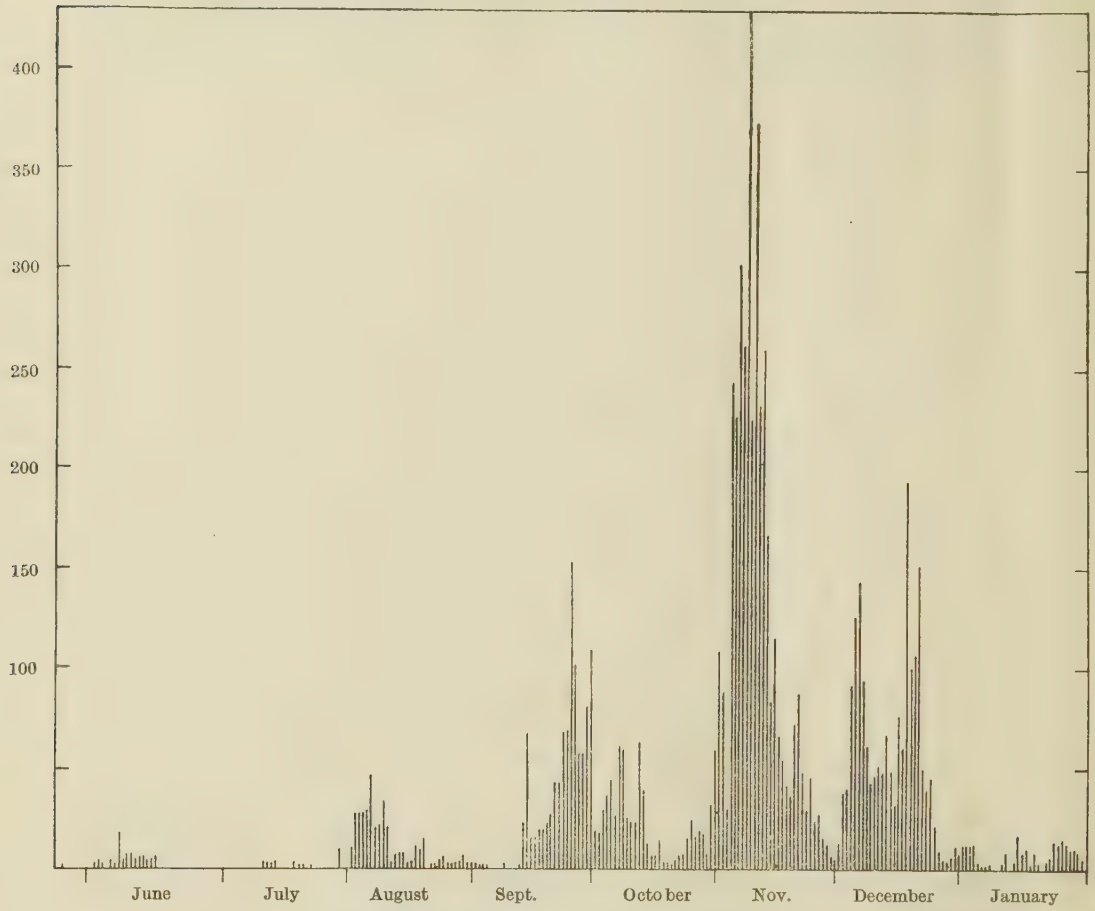


**Fig. 3.—Daily emergences of *L. coffeella*.**

generation recorded is spread over twelve days only; in the second about twenty-two and in the third about thirty-five days.

If this "dominant stage" condition really exists in outbreaks of *L. coffeella*, we should expect marked periodicity in the number of eggs laid; the majority will be laid shortly after the emergence of the majority of adults. It also explains the periodicity in percentage emergences—figure 2. If a collection of mines is made when the "dominant stage" is young larvae, comparatively few will survive to emerge as adults, whereas if the collection is made when

*By "stage" is meant rather vaguely a short period of time in the life history; the "stages" referred to may mean eggs, young larvae, medium sized larvae, old larvae, pupae or adults.

the "dominant stage" is old larvae, a large percentage may be expected to emerge.

Figure 4 represents the numbers of the three most important larval parasites of *L. coffeella* emerging from the collections, *Atoposoma variegatum* var *afra* Masi; *Achrysocharella ritchei* Ferr. and *Apanteles bordagei* Giard. It will be noted that all these parasites were present right from the beginning of the records, but for a considerable time they did not increase. In August all

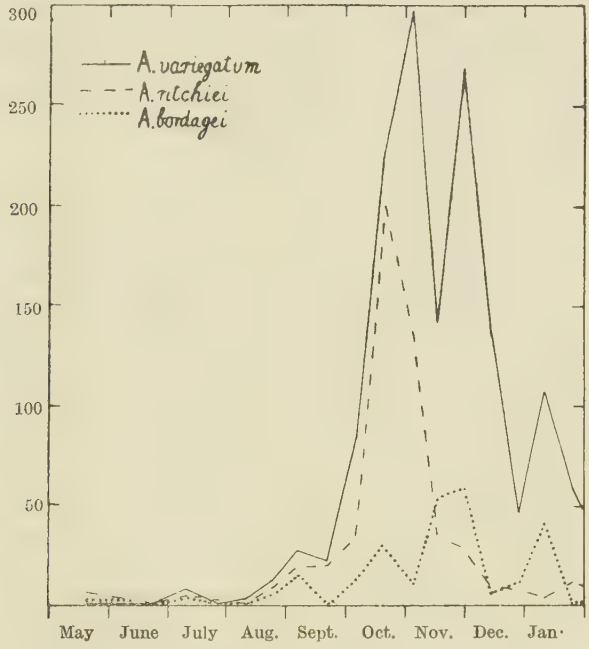


**Fig. 4.—Total emergences of parasites from collection of larvae.**

started to increase in numbers, were checked slightly in September, but then rapidly increased again until in December the outbreak came under control. The period May to October can be taken as the period of unchecked host increase, which gives an increase (by egg counts) of about three times per generation of forty-seven days. Similarly the increase of, for instance, *Atoposoma* can be calculated over the period of unchecked increase—September to October, and can be shown to be about six times per generation of twenty-three days whilst that of *Achrysocharella ritchei* is about the same. It is obvious then that in normal circumstances *L. coffeella* cannot become epidemic in the presence of either *Atoposoma* or *Achrysocharella*. It seems fairly certain that the reason it did so lies in the combination of the "dominant stage" condition of the pest and the short life history of the parasites. The parasites of any particular stage of the host, since they have a much shorter life history than the host, will hatch out at a time when this stage is rare and their chances of surviving until this stage is common again are small. Thus these parasites will not increase until the stages of the host are sufficiently spread in time to permit the progeny of any parasite a reasonable chance of obtaining plenty of hosts to attack. This did not take place until September, after which the outbreak was rapidly subdued.

It will be noted that the scale of figure 4 is much greater than that of figure 1 and apparently the larval parasites, if this is a true picture of what happens in the field, are not in fact controlling the outbreak. This is true, but since in this experiment only larvae are collected and these are mostly less than a fortnight old from hatching, the pupal parasites and the parasites of the fully grown larvae do not appear. Most of these appear in the pupal collections. A serious criticism of the method is, however, that whilst parasites which attack fully grown larvae, but allow these to pupate, will be obtained in pupal collections (that is, Braconids), Chalcid parasites of the fully grown larvae will be missed. A check collection was made from neighbouring trees on the 9th September, for comparison with the collection of the 7th September. These trees had not been stripped a fortnight previously, as had the experimental trees, and it was shown that this criticism is not a very serious one.

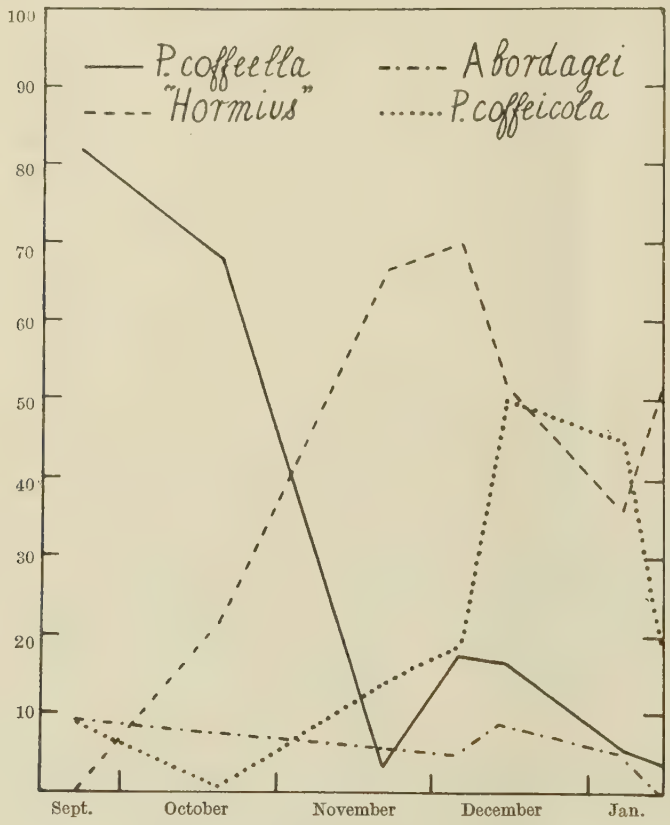


**Fig. 5.—Experiment IX** *L. Coffeella.*
**Percentage of emergences of parasites from collections of pupae.**

Pupal collections are shown in figure 5, where the percentages of the total emergences of the three important parasites and of the host are shown. Of the parasites, it is obvious that the Braconid, described by the British Museum as a new genus near *Hormius*, is the most important. It apparently attacks fully grown larvae in the mine and larvae which has spun up; it may attack

pupae also. In September eighty-one per cent of the pupae were escaping parasitism, but this percentage was rapidly reduced, almost entirely by *Hormius*, until in November the percentage escaping was only ten per cent; *Hormius* accounting for sixty-eight per cent. (Average of the two collections 21st November and 5th December.)

There appear to be no egg parasites.

From these figures it is possible to get a picture of the whole outbreak. Until September the host was able to multiply almost unchecked, which it did at an approximate rate of three times per generation. From then onwards parasites, larval and pupal, influenced the situation as shown in the following table:—

| | I<br>Percentage of hosts escaping larval parasitism | II<br>Percentage of hosts escaping pupal parasitism | III<br>Percentage of hosts escaping parasitism (I and II) throughout life |
|---|---|---|---|
| September ... ... | 84 ... | 81 ... | 68 |
| October ... ... | 86 ... | 64 ... | 55 |
| November ... ... | 76 ... | 10 ... | 7·6 |

It will be seen that the greatest controlling influence is the so-called pupa parasites (that is, parasites emerging from collections of pupae). Since the rate of increase of *L. coffeella* is three per generation, if 33·3 per cent of the hosts escape parasitism the numbers of the host will remain stationary, while if less, they will decrease. This point must have been reached about the beginning of November (*vide* figure 5), so that the climax of the outbreak should have been reached then. That this actually happened in the field is shown by the egg-counts (figure 1).

Summarizing the practical aspect of the problem, *L. coffeella* cannot become epidemic in the presence of its parasites expect when the host assumes the "dominant stage" condition. The fundamental control of *L. coffeella* is therefore the prevention of this "dominant stage."

*Experiment IX—L. daricella.*—There is little of economic interest about *L. daricella* in unshaded conditions. Figure 6 shows the egg counts over this period. It is notable, however, that this species also shows the same periodicity of egg laying associated with the "dominant stage"; but the two periods are not in step—for instance *L. coffeella* shows a trough in August, whilst *L. daricella* shows a peak. The general trend of the curve, however, is the same, increasing from May until November, and thereafter decreasing, but the numbers are small; compare the peak of *L. daricella*, sixty-three per tree with that of *L. coffeella*, 1,740 per tree.

*Amani Selections* (shade conditions).—Here the picture is as yet much less clear. At the beginning of the experiment *L. daricella* and *L. coffeella* were present in about equal numbers, and doing considerable damage. *L. coffeella* came under control almost immediately, *L. daricella* much more slowly. By the end of August both were rare. Immediately after this a serious outbreak of *L. daricella* took place, the egg counts reaching 1,600 per tree by the beginning of November, while *L. coffeella* followed suit though with much smaller numbers (150 per tree). The egg counts of *L. daricella* showed a second peak in early December, then dropped, while those of *L. coffeella* showed both a second peak in early December and a third early in January. From the collections it does not appear that the larval parasites of *L. daricella* are important. The late

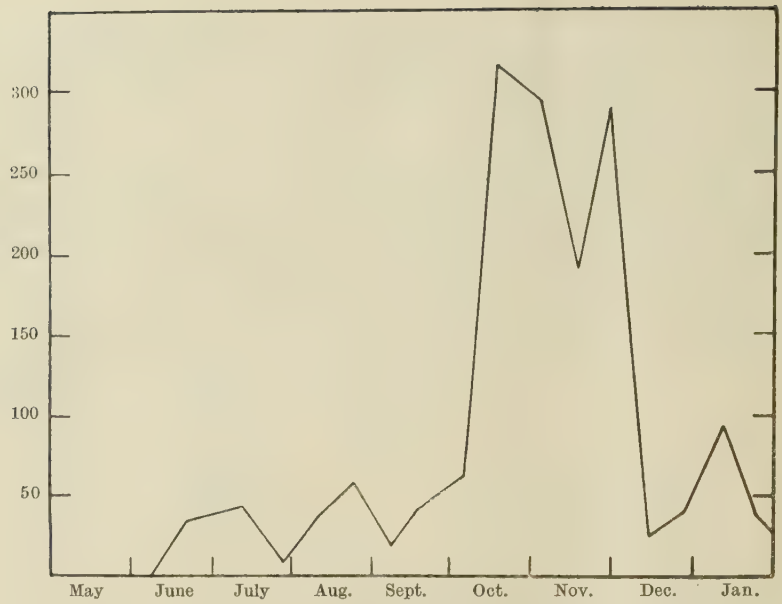


**Fig. 6.—Experiment IX** *L. Daricella.*
**Number of eggs from five trees.**

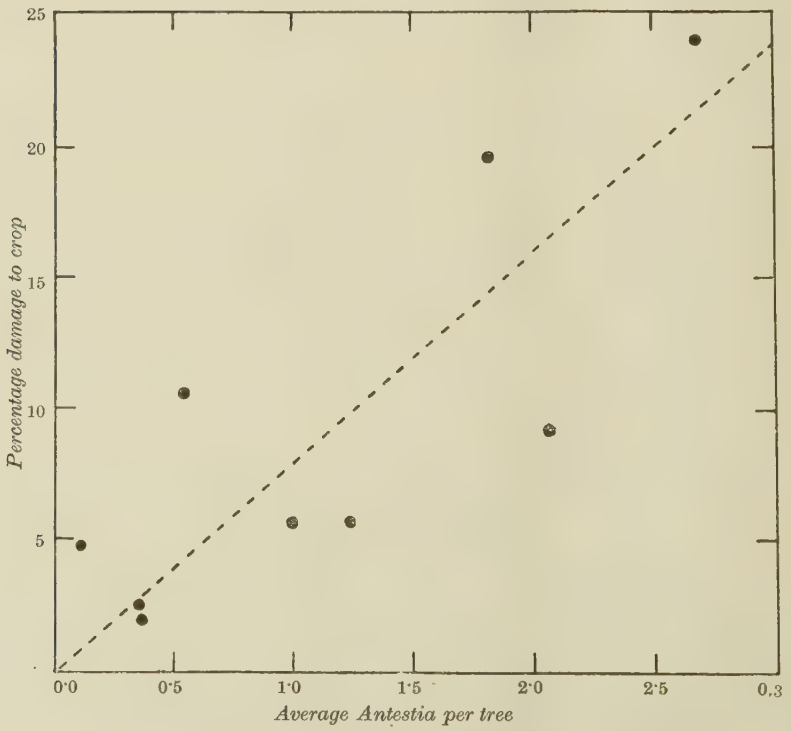


**Fig. 7.—Correlation of Antestia infestation and damage.**

larval and pupal parasites however are very important; it is rare to hatch an adult *daricella* from a pupa in the field. But in a small collection of pupae made in September, fifty per cent of the total hatchings were *daricella*. It seems probable that the late larval, prepupal and pupal parasites are the important controlling factors; that *L. daricella* is capable of a very rapid increase when released from these parasites—about eight times per generation —and that it may thus suddenly appear and do very serious damage, amounting sometimes to almost total defoliation. Since many of the parasites appear to be common to both species of moth, the presence of each will influence the other. The reasons for the failure of these parasites, and consequent epidemics, require further study.

### ANTESTIA

*Antestia* work was the second most important project during the year. A note on *Antestia* control was published in *Quarterly Notes* for June and a demonstration of test spraying given in the Uru district in July. Efforts have been mainly directed towards the encouragement of test spraying, to give planters the opportunity to decide for themselves, on sound evidence, the effectiveness of various control measures and to make the discovery of early infestations possible. As regards experimental work, field tests of impregnated dusts have been carried out at Marangu and close to the station, but since *Antestia* has been rather scarce on Kilimanjaro this year, further tests were arranged on Meru for January, where *Antestia* is much in evidence.

An investigation of (1) the seasonal abundance of *Antestia*; (2) the influence of the bait-spraying campaign; and (3) the occurrence of *Corioxenos*, was started in the Uru district and Meru in September and November respectively. Two agricultural instructors were trained in test spraying, and regularly test various plantations in these areas. All the *Antestia* thus obtained are examined for *Corioxenos*. The work has not yet been in progress long enough to justify further comment, except that in Uru, where the numbers of *Antestia* have been small, *Corioxenos* has been extremely rare this year, whereas in Arusha where the numbers are higher, it is comparatively common.

Some interesting figures on the effect of *Antestia* on the crop were obtained from the station. Though the numbers of *Antestia* found by test spraying were small, damage was severe. Most of this damage results in the production of light beans, which are thrown out in the preparation of coffee. Since both test spraying and picking is carried out in blocks, it is possible to show some correlation between *Antestia* numbers and damage. Figure 7 shows in graphical form the result of examining one hundred cherries from each of these plots, expressed as a percentage of beans showing *Antestia* damage. Such damaged beans include those which are shrivelled vestiges and stained, but do not include unstained shrivelled vestiges.

It should be emphasized that the amount of damage will not be constant for the number of *Antestia* per tree: it will depend on other factors also—for instance, the percentage of the *Antestia* infected with *Nematospora*. The figures, however, are surprising: it has been stated that *Antestia* need not be controlled until an average of two *Antestia* per tree is found. On this occasion at least it would appear that two *Antestia* per tree represent over fifteen per cent damage to the crop, or at four hundredweights per acre at fifty pounds per ton a loss of thirty shillings per acre. On the station we are aiming to prevent *Antestia* exceeding an average of one per tree in any block, using pyrethrum powder as a control, and test spraying at regular intervals.

Studies on Thrips have been continued and weekly counts have been made on experiment IX. In mid-October the critical temperature was exceeded and the indications were that Thrips would be serious. During November and December, however, temperatures were lower than usual and the numbers of Thrips actually decreased, despite drought conditions. At the end of the year the position is that the number of Thrips present is very small, but unless January and February are abnormally cool an outbreak may still take place: the outbreak will not be so severe as was feared in October, but may still be serious.

The previous year it was forecast (annual report 1937) "that little damage need be anticipated from Thrips." Actually Thrips remained extremely rare on the station throughout the season, despite normally high temperatures in January, February and March.

Lyamungu, F. B. NOTLEY

March 1939. *Entomologist*

## Statement of Expenditure for the period 1st January to 31st December 1938

*Colonial Development Fund—V. Coffee Research Station*

### I.—Personal Emoluments

| | Provision Shs | | Expenditure Shs | Cts |
|---|---|---|---|---|
| 1. Chief Scientific Officer ... ... ... | | | 23,814 | 49 |
| 2. Chemist ... ... ... ... ... | | | 14,400 | 00 |
| 3. Agricultural Assistant ... ... ... | | | 6,646 | 77 |
| 4. European Clerk ... ... ... ... | | | 9,600 | 00 |
| 5. Asiatic Clerk ... ... ... ... | 67,600 | ... | 3,441 | 66 |
| 6. (a) Laboratory Assistant ... ... | | | 870 | 00 |
| (b) African Assistants ... ... ... | | | 647 | 58 |
| 7. (a) Mechanic ... ... ... ... | | | 1,830 | 16 |
| (b) African Assistants ... ... ... | | | 197 | 50 |
| 8. African Overseer ... ... ... | | | 325 | 65 |
| 9. Messengers ... ... ... ... | | | 313 | 69 |
| | 67,600 | ... | 62,087 | 50 |
| Transferred to Item 11 ... ... ... | 5,238 | | | |
| | 62,362 | | | |

### II.—Other Charges

| | | | | |
|---|---|---|---|---|
| 10. Incidental Expenses: | | | | |
| (a) Stationery ... ... ... ... | 700 | ... | 494 | 56 |
| (b) Contingencies ... ... ... | | ... | 187 | 25 |
| | 700 | ... | 681 | 81 |
| 11. Farm Operations and Experimental Work: | | | | |
| (a) Labour ... ... ... ... | | | 12,144 | 79 |
| (b) Recorders ... ... ... ... | | | 7,309 | 26 |
| (c) Field Experiments off Station ... | | | 1,121 | 93 |
| (d) Upkeep and Maintenance of Motor Vehicles | 24,980 | ... | 1,993 | 83 |
| (e) Maintenance of Power, Gas and Water Plants ... ... ... ... | | | 2,497 | 61 |
| (f) Books and Periodicals ... ... | | | 994 | 27 |
| (g) Laboratory Equipment and Materials | | | 2,959 | 83 |
| (h) Upkeep of Coffee Factory ... ... | | | 986 | 72 |
| | 24,980 | ... | 30,008 | 24 |
| Transferred from Personal Emoluments | 5,238 | | | |
| | *30,218 | | | |

*Shs 13,280 met from Head VI.—Agriculture.